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## ANNEX I

### Benchmarks

1. Definition of product benchmarks and system boundaries without consideration of exchangeability of fuel and electricity

<b>Product benchmark</b>	<b>Definition of products covered</b>	<b>Definition of processes and emissions covered (system boundaries)</b>	<b>Starting point for determination of annual reduction rate for benchmark value update(allowances/t)</b>
Coke	Coke-oven coke (obtained from the carbonisation of coking coal, at high temperature) or gas-works coke (by-product of gas-works plants) expressed in tonnes of dry coke, determined at the discharge of the coke oven or gas-works plant. Lignite coke is not covered by this benchmark. Coking in refineries is not included but covered by the CWT methodology for refineries.	All processes directly or indirectly linked to the process units coke ovens, H <sub>2</sub> S/ NH <sub>3</sub> incineration, coal preheating (defreezing), coke gas extractor, desulphurisation unit, distillation unit, steam generation plant, pressure control in batteries, biological water treatment, miscellaneous heating of by-products and hydrogen separator are included. Coke oven gas cleaning is included.	0,286
Sintered ore	Agglomerated iron-bearing product containing iron ore fines, fluxes and iron-containing recycling materials with the chemical and physical properties such as the level of basicity, mechanical strength and permeability required to deliver iron and necessary flux materials into iron ore reduction	All processes directly or indirectly linked to the process units sinter strand, ignition, feedstock preparation units, hot screening unit, sinter cooling unit, cold screening unit and steam generation unit are included.	0,171

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	processes. Expressed in tonnes of sintered ore as leaving the sinter plant.		
Hot metal	Liquid iron saturated with carbon for further processing, considered as product of blast furnaces, and expressed in tonnes of liquid iron at the exit point of the blast furnace. Similar products such as ferroalloys are not covered by this product benchmark. Residual material and by-products are not to be considered as part of the product.	All processes directly or indirectly linked to the process units blast furnace, hot metal treatment units, blast furnace blowers, blast furnace hot stoves, basic oxygen furnace, secondary metallurgy units, vacuum ladles, casting units (including cutting), slag treatment unit, burden preparation, BF gas treatment unit, dedusting units, scrap pre-heating, coal drying for PCI, vessels preheating stands, casting ingots preheating stands, compressed air production, dust treatment unit (briquetting), sludge treatment unit (briquetting), steam injection in BF unit, steam generation plant, converter BOF gas cooling and miscellaneous are included.	1,328
Pre-bake anode	Anodes for aluminium electrolysis use consisting of petrol coke, pitch and normally recycled anodes, which are formed to shape specifically intended for a particular smelter and baked in anode baking ovens to a temperature of around 1 150 °C. Söderberg anodes are	All processes directly or indirectly linked to the production of pre-bake anodes are included.	0,324

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	not covered by this product benchmark.		
Aluminium	Unwrought non-alloy liquid aluminium from electrolysis. Expressed in tonnes measured between the electrolysis section and the holding furnace of the cast house, before alloys and secondary aluminium are added.	All processes directly or indirectly linked to the production step electrolysis are included. Emissions resulting from holding furnaces and casting, and emissions related to anode productions are excluded.	1,514
Grey cement clinker	Grey cement clinker as total clinker produced.	All processes directly or indirectly linked to the production of grey cement clinker are included.	0,766
White cement clinker	White cement clinker for use as main binding component in the formulation of materials such as joint fillers, ceramic tile adhesives, insulation, and anchorage mortars, industrial floor mortars, ready mixed plaster, repair mortars, and water-tight coatings with maximum average contents of 0,4 mass-% Fe <sub>2</sub> O <sub>3</sub> , 0,003 mass-% Cr <sub>2</sub> O <sub>3</sub> and 0,03 mass-% Mn <sub>2</sub> O <sub>3</sub> . Expressed in tonnes of white cement clinker (as 100 % clinker).	All processes directly or indirectly linked to the production of white cement clinker are included.	0,987
Lime	Quicklime: calcium oxide (CaO) produced by the decarbonation of limestone (CaCO <sub>3</sub> ). Expressed in tonnes of 'standard pure' defined as lime with a free CaO	All processes directly or indirectly linked to the production of lime are included.	0,954

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	<p>content of 94,5 %. Lime produced and consumed in the same installation for purification processes is not covered by this product benchmark. The internal lime production of the pulp sector is already covered by the respective pulp benchmarks and is therefore not eligible for additional allocation based on the lime benchmark.</p>		
Dolime	<p>Dolime or calcined dolomite as mixture of calcium and magnesium oxides produced by the decarbonation of dolomite (<math>\text{CaCO}_3 \cdot \text{MgCO}_3</math>) with a residual <math>\text{CO}_2</math> exceeding 0,25 %, a free MgO content between 25 % and 40 % and a bulk density of the commercial product below 3,05 g/cm<sup>3</sup>. Dolime shall be expressed as 'standard pure dolime' quality with a free CaO content of 57,4 % and a free MgO content of 38,0 %.</p>	All processes directly or indirectly linked to the production of dolime are included, in particular fuel preparation, calcination/sintering and flue gas treatment.	1,072
Sintered dolime	<p>Mixture of calcium and magnesium oxides used solely for the production of refractory bricks and other refractory products with a minimum bulk density of 3,05 g/cm<sup>3</sup>. Expressed in tonnes</p>	All processes directly or indirectly linked to the production of sintered dolime are included.	1,449

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	of saleable sintered dolime.		
Float glass	Float/ground/polish glass. (as tons of glass exiting the lehr).	All processes directly or indirectly linked to the production steps melter, refiner, working end, bath and lehr are included. Finishing workshops that can be physically separated from the upstream process, such as offline coating, laminating and toughening are excluded.	0,453
Bottles and jars of colourless glass	Bottles of colourless glass of a nominal capacity < 2,5 litres, produced in a furnace where there is no deliberate addition of colour for beverages and foodstuffs (excluding bottles covered with leather or composition leather; infant's feeding bottles) except extra-white flint products with an iron oxide content expressed as percent Fe <sub>2</sub> O <sub>3</sub> by weight lower than 0,03 % and colour co-ordinates of L in the range 100 to 87, of a in the range 0 to – 5 and of b in the range 0 to 3 (using the CIELAB advocated by the Commission Internationale d'éclairage) expressed as tonnes of packed product.	All processes directly or indirectly linked to the production steps materials handling, melting, forming, downstream processing, packaging and ancillary processes are included.	0,382
Bottles and jars of coloured glass	Bottles of coloured glass of a nominal capacity < 2,5 litres, for beverages and	All processes directly or indirectly linked to the production steps materials	0,306

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	foodstuffs (excluding bottles covered with leather or composition leather; infant's feeding bottles), not meeting the definition of the product benchmark for bottles and jars of colourless glass, expressed as tonnes of packed product.	handling, melting, forming, downstream processing, packaging and ancillary processes are included.	
Continuous filament glass fibre products	Melted glass for the production of continuous filament glass fibre products namely chopped strands, rovings, yarns and staple glass fibre and mats, expressed as tonnes of melted glass exiting the forehearth calculated from the quantity of raw material input into the furnace after subtraction of the volatile gaseous emissions. Mineral wool products for thermal, acoustic and fire insulation are not covered by this benchmark.	All processes directly or indirectly linked to the production processes glass melting in the furnaces and glass refining in the forehearth are included, in particular direct CO <sub>2</sub> emissions associated to these process CO <sub>2</sub> emissions resulting from the decarbonatisation of the glass mineral raw materials during the melting process. Downstream processes to convert the fibres into sellable products are not included in this product benchmark. Supporting processes such as material handling are regarded as utilities and are outside the system boundaries.	0,406
Facing bricks	Facing bricks with a density > 1 000 kg/m <sup>3</sup> used for masonry based on EN 771-1, excluding pavers, clinker bricks and blue braised facing bricks.	All processes directly or indirectly linked to the production processes raw material preparation, component mixing, forming and shaping of ware, drying of ware, firing of ware, product finishing and	0,139

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		flue gas cleaning are included.	
Pavers	Clay bricks of any color used for flooring according to EN 1344. Expressed in tonnes of paves as net saleable product.	All processes directly or indirectly linked to the production processes raw material preparation, component mixing, forming and shaping of ware, drying of ware, firing of ware, product finishing and flue gas cleaning are included.	0,192
Roof tiles	Clay roofing tiles as defined in EN 1304:2005 excluding blue braised roof tiles and accessories. Expressed in tonnes of saleable roof tiles.	All processes directly or indirectly linked to the production processes raw material preparation, component mixing, forming and shaping of ware, drying of ware, firing of ware, product finishing and flue gas cleaning are included.	0,144
Spray dried powder	Spray-dried powder for the production of dry-pressed wall and floor tiles. Expressed in tonnes of powder produced.	All processes directly or indirectly linked to the production of spray-dried powder are included.	0,076
Plaster	Plasters consisting of calcined gypsum or calcium sulphate (including for use in building, for use in dressing woven fabrics or surfacing paper, for use in dentistry, for use in land remediation), in tonnes of stucco (saleable production). Alpha plaster, plaster that is further processed to plasterboard and the production of the intermediate product dried secondary	All processes directly or indirectly linked to the production steps milling, drying and calcining are included.	0,048

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	gypsum are not covered by this product benchmark.		
Dried secondary gypsum	Dried secondary gypsum (synthetic gypsum produced as a recycled by-product of the power industry or recycled material from construction waste and demolition) expressed as tonnes of product.	All processes directly or indirectly linked to the drying of secondary gypsum are included	0,017
Short fibre kraft pulp	Short fibre kraft pulp is a wood pulp produced by the sulphate chemical process using cooking liquor, characterised by fibre lengths of 1 – 1,5 mm, which is mainly used for products which require specific smoothness and bulk, as tissue and printing paper, expressed as net saleable production in air dried tonnes, measured at the end of the production process, Air dry metric tonne of pulp meaning dry solids content of 90 %.	All processes which are part of the pulp production process (in particular the pulp mill, recovery boiler, pulp drying section and lime kiln and connected energy conversion units (boiler/CHP)) are included. Other activities on site that are not part of this process such as sawmilling activities, woodworking activities, production of chemicals for sale, waste treatment (treating waste onsite instead of offsite (drying, pelletising, incinerating, landfilling), PCC (precipitated calcium carbonate) production, treatment of odorous gases, and district heating are not included.	0,12
Long fibre kraft pulp	Long fibre kraft pulp is a wood pulp produced by the sulphate chemical process using cooking liquor, characterised	All processes which are part of the pulp production process (in particular the pulp mill, recovery boiler, pulp drying section and lime	0,06



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	<p>by fibre lengths of 3 – 3,5 mm, including bleached and unbleached pulp, expressed as net saleable production in air dried tonnes, measured at the end of the production process. Air dry metric tonne of pulp meaning dry solids content of 90 %.</p>	<p>kiln and connected energy conversion units (boiler/CHP)) are included. Other activities on site that are not part of this process such as sawmilling activities, woodworking activities, production of chemicals for sale, waste treatment (treating waste onsite instead of offsite (drying, pelletising, incinerating, landfilling), PCC (precipitated calcium carbonate) production, treatment of odorous gases, and district heating are not included.</p>	
<p>Sulphite pulp, thermo-mechanical and mechanical pulp</p>	<p>Sulphite pulp produced by a specific pulp making process, e.g. pulp produced by cooking wood chips in a pressure vessel in the presence of bisulphite liquor expressed as net saleable production in air dried metric tonnes measured at the end of the production process. Air dry metric tonne of pulp meaning dry solids contents of 90 %. Sulphite pulp can be either bleached or unbleached. Mechanical pulp grades: TMP (thermomechanical pulp) and groundwood as net saleable production in air dried metric tonnes measured</p>	<p>All processes which are part of the pulp production process (in particular the pulp mill, recovery boiler, pulp drying section and lime kiln and connected energy conversion units (boiler/CHP)) are included. Other activities on site that are not part of this process such as sawmilling activities, woodworking activities, production of chemicals for sale, waste treatment (treating waste onsite instead of offsite (drying, pelletising, incinerating, landfilling), PCC (precipitated calcium carbonate) production, treatment of odorous gases, and</p>	<p>0,02</p>

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	<p>at the end of the production process. Air dry metric tonne of pulp meaning dry solids contents of 90 %. Mechanical pulp can be either bleached or unbleached. Not covered by this group are the smaller subgroups of semichemical pulp CTMP – chemithermomechanical pulp and dissolving pulp.</p>	<p>district heating are not included.</p>	
Recovered paper pulp	<p>Pulps of fibres derived from recovered (waste and scrap) paper or paperboard or of other fibrous cellulosic material expressed in tonnes of saleable production in air dried metric tonnes measured at the end of the production process. Air dry metric tonne of pulp meaning dry solids contents of 90 %. In case of pulp production, the production is defined as the total pulp produced including both pulp for internal delivery to a paper mill and market pulp.</p>	<p>All processes which are part of the production of pulp from recovered paper and connected energy conversion units (boiler/CHP) are included. Other activities on site that are not part of this process such as sawmilling activities, woodworking activities, production of chemicals for sale, waste treatment (treating waste onsite instead of offsite (drying, pelletising, incinerating, landfilling), PCC (precipitated calcium carbonate) production, treatment of odorous gases, and district heating are not included.</p>	0,039
Newsprint	<p>Specific paper grade (in rolls or sheets) expressed as net saleable production in air dried tonnes, defined as paper with 6 % moisture content.</p>	<p>All processes which are part of the paper production process (in particular paper or board machine and connected energy conversion units (boiler/CHP) and</p>	0,298

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		<p>direct process fuel use) are included. Other activities on site that are not part of this process such as sawmilling activities, woodworking activities, production of chemicals for sale, waste treatment (treating waste onsite instead of offsite (drying, pelletising, incinerating, landfilling), PCC (precipitated calcium carbonate) production, treatment of odorous gases, and district heating are not included.</p>	
Uncoated fine paper	<p>Uncoated fine paper, covering both uncoated mechanical and uncoated woodfree expressed as net saleable production in air dried tonnes, defined as paper with 6 % moisture content.</p> <p>1. Uncoated woodfree papers covers papers suitable for printing or other graphic purposes made from a variety of mainly virgin fibre furnishes, with variable levels of mineral filler and</p>	<p>All processes which are part of the paper production process (in particular paper or board machine and connected energy conversion units (boiler/CHP) and direct process fuel use) are included. Other activities on site that are not part of this process such as sawmilling activities, woodworking activities, production of chemicals for sale, waste treatment (treating waste onsite instead of offsite (drying, pelletising, incinerating, landfilling), PCC (precipitated calcium carbonate) production, treatment of odorous gases, and district heating are not included.</p>	0,318

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	2. a range of finishing processes. Uncoated mechanical papers cover the specific paper grades made from mechanical pulp, used for packaging or graphic purposes/ magazines.		
Coated fine paper	Coated fine paper covering both coated mechanical and coated woodfree papers expressed as net saleable production in air dried tonnes, defined as paper with 6 % moisture content.	All processes which are part of the paper production process (in particular paper or board machine and connected energy conversion units (boiler/CHP) and direct process fuel use) are included. Other activities on site that are not part of this process such as sawmilling activities, woodworking activities, production of chemicals for sale, waste treatment (treating waste onsite instead of offsite (drying, pelletising, incinerating, landfilling), PCC (precipitated calcium carbonate) production, treatment of odorous gases, and district heating are not included.	0,318
Tissue	Tissue papers, covering a wide range of tissue and other hygienic papers	All processes which are part of the paper production process (in particular paper	0,334

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	<p>for use in households or commercial and industrial premises such as toilet paper and facial tissues, kitchen towels, hand towels and industrial wipes, the manufacture of baby nappies, sanitary towels, etc. TAD - Through Air Dried Tissue is not part of this group. Expressed as tonnes of net saleable production of parent reel in air dried tonnes, defined as paper with 6 % moisture content.</p>	<p>or board machine and connected energy conversion units (boiler/CHP) and direct process fuel use) are included. Other activities on site that are not part of this process such as sawmilling activities, woodworking activities, production of chemicals for sale, waste treatment (treating waste onsite instead of offsite (drying, pelletising, incinerating, landfilling), PCC (precipitated calcium carbonate) production, treatment of odorous gases, and district heating are not included. The conversion of parent reel weight to finished products is not part of this product benchmark.</p>	
Testliner and fluting	<p>Testliner and fluting expressed as net saleable production in air dried tonnes defined as paper with 6 % moisture content.</p> <p>1. Testliner covers types of paperboard that meet specific tests adopted by the packaging industry to qualify for use as the outer facing layer for</p>	<p>All processes which are part of the paper production process (in particular paper or board machine and connected energy conversion units (boiler/CHP) and direct process fuel use) are included. Other activities on site that are not part of this process such as sawmilling activities, woodworking activities, production of chemicals for sale, waste treatment (treating waste onsite instead of offsite</p>	0,248

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	<p>2. corrugated board, from which shipping containers are made. Fluting refers to the centre segment of corrugated shipping containers, being faced with linerboard (testliner/ kraftliner) on both sides. Fluting covers mainly papers made from recycled fibre but this group also holds paperboard that is made from chemical and semi-chemical pulp. Kraftliner is not included in this product benchmark.</p>	<p>(drying, pelletising, incinerating, landfilling), PCC (precipitated calcium carbonate) production, treatment of odorous gases, and district heating are not included.</p>	
Uncoated carton board	<p>Various uncoated products (expressed as net saleable production in air dried tonnes, defined as paper with 6 % moisture content) which may be single or multiply. Uncoated carton board is mainly</p>	<p>All processes which are part of the paper production process (in particular paper or board machine and connected energy conversion units (boiler/CHP) and direct process fuel use) are included. Other activities</p>	0,237

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	<p>used for packaging applications which the main needed characteristic is strength and stiffness, and for which the commercial aspects as information carrier are of a second order of importance. Carton board is made from virgin and/or recovered fibres, has good folding properties, stiffness and scoring ability. It is mainly used in cartons for consumer products such as frozen food, cosmetics and for liquid containers; also known as solid board, folding box board, boxboard or carrier board or core board.</p>	<p>on site that are not part of this process such as sawmilling activities, woodworking activities, production of chemicals for sale, waste treatment (treating waste onsite instead of offsite (drying, pelletising, incinerating, landfilling), PCC (precipitated calcium carbonate) production, treatment of odorous gases, and district heating are not included.</p>	
Coated carton board	<p>This benchmark covers a wide range of coated products (expressed as net saleable production in air dried tonnes, defined as paper with 6 % moisture content) which may be single or multiply. Coated carton board is mainly used for commercial applications that need to bring commercial information printed on the packaging to the shelf in the store in applications such as food, pharma, cosmetics, and other. Carton board is made from virgin and/or recovered fibres, and has good folding properties,</p>	<p>All processes which are part of the paper production process (in particular paper or board machine and connected energy conversion units (boiler/CHP) and direct process fuel use) are included. Other activities on site that are not part of this process such as sawmilling activities, woodworking activities, production of chemicals for sale, waste treatment (treating waste onsite instead of offsite (drying, pelletising, incinerating, landfilling), PCC (precipitated calcium carbonate)</p>	0,273

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	stiffness and scoring ability. It is mainly used in cartons for consumer products such as frozen food, cosmetics and for liquid containers; also known as solid board, folding box board, boxboard or carrier board or core board.	production, treatment of odorous gases, and district heating are not included.	
Nitric acid	Nitric acid (HNO <sub>3</sub> ), to be recorded in tonnes HNO <sub>3</sub> (100 % purity).	All processes directly or indirectly linked to the production of the benchmarked product as well as the N <sub>2</sub> O destruction process are included except the production of ammonia.	0,302
Adipic acid	Adipic acid to be recorded in tonnes of dry purified adipic acid stored in silos or packed in (big)bags. Salts and esters of adipic acid are not covered by this product benchmark.	All processes directly or indirectly linked to the production of the benchmarked product as well as the N <sub>2</sub> O destruction process are included.	2,79
Vinyl chloride monomer (VCM)	Vinyl chloride (chloroethylene). Expressed in tonnes of vinyl chloride (saleable product, 100 % purity).	All processes directly or indirectly linked to the production steps direct chlorination, oxychlorination and EDC cracking to VCM are included. Direct chlorination refers to chlorination of ethylene. Oxychlorination refers to chlorination of ethylene with hydrogen chloride (HCl) and oxygen. The incineration of chlorinated hydrocarbons contained in the vent gases of EDC/ VCM production is included in the	0,204



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		benchmark. The production of oxygen and compressed air used as raw materials in VCM manufacture are excluded from the benchmark.	
Phenol/acetone	Sum of phenol, acetone and the by-product alpha-methyl styrene as total production, expressed in tonnes of saleable product at 100 % purity.	All processes directly or indirectly linked to the production of phenol and acetone are included, in particular air compression, hydroperoxidation, cumene recovery from spent air, concentration & cleavage, production fractionation & purification, tar cracking, acetophenone recovery & purification, AMS recovery for export, AMS hydrogenation for ISB recycle, initial waste water purification (1st waste water stripper), cooling water generation (e.g., cooling towers), cooling water utilisation (circulation pumps), flare & incinerators (even if physically located OSB) as well as any support fuel consumption.	0,266
S-PVC	Polyvinyl chloride; not mixed with any other substances consisting of PVC particles with a mean size between 50 and 200 µm. Expressed in tonnes of S-PVC	All processes directly or indirectly linked to the production of S-PVC are included except the production of VCM.	0,085

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	(saleable product, 100 % purity).		
E-PVC	Polyvinyl chloride; not mixed with any other substances consisting of PVC particles with a mean size between 0,1 and 3 µm. Expressed in tonnes of E-PVC (saleable product, 100 % purity).	All processes directly or indirectly linked to the production of E-PVC are included except the production of VCM.	0,238
Soda ash	Disodium carbonate, expressed in tonnes of soda ash as total gross production except dense soda ash obtained as by-product in a caprolactam production network.	All processes directly or indirectly linked to the process units brine purification, limestone calcination and milk of lime production, absorption of ammonia, precipitation of NaHCO <sub>3</sub> , filtration or Separation of NaHCO <sub>3</sub> crystals from mother liquor, decomposition of NaHCO <sub>3</sub> to Na <sub>2</sub> CO <sub>3</sub> , recovery of ammonia and densification or production of dense soda ash are included.	0,843

If no other reference is given, all product benchmarks refer to 1 ton of product produced expressed as saleable (net) production and to 100 % purity of the substance concerned.

All definitions of processes and emissions covered (system boundaries) include flares where they occur.

2. Definition of product benchmarks and system boundaries with consideration of exchangeability of fuel and electricity

<b>Product benchmark</b>	<b>Definition of products covered</b>	<b>Definition of processes and emissions covered (system boundaries)</b>	<b>Starting point for determination of annual reduction rate for benchmark value update(allowances/t)</b>
Refinery products	Mix of refinery products with more	All processes of a refinery matching	0,0295

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	<p>than 40 % light products (motor spirit (gasoline) including aviation spirit, spirit type (gasoline type) jet fuel, other light petroleum oils/ light preparations, kerosene including kerosene type jet fuel, gas oils) expressed as CO<sub>2</sub> weighted tonne (CWT). Refineries with other product mixes are not covered by this product benchmark.</p>	<p>the definition of one of the CWT process units as well as ancillary non-process facilities operating inside the refinery fence-line such as tankage, blending, effluent treatment, etc. are included. Lube oils and bitumen processing units located in mainstream refineries are also included in the refinery CWT and emissions envelope. Process units pertaining to other sectors, such as petrochemicals, are sometimes physically integrated with the refinery. Such process units and their emissions are excluded from the CWT approach. For the determination of indirect emissions, the total electricity consumption within the system boundaries shall be considered.</p>	
EAF carbon steel	<p>Steel containing less than 8 % metallic alloying elements and tramp elements to such levels limiting the use to those applications where no high surface quality and processability is required and if none of the criteria for the content of the metal alloying elements and the steel quality for high alloy steel are met. Expressed</p>	<p>All processes directly or indirectly linked to the process units electric arc furnace, secondary metallurgy, casting and cutting, post-combustion unit, dedusting unit, vessels heating stands, casting ingots preheating stands, scrap drying and scrap preheating are included. Processes downstream of</p>	0,283

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	in tonnes of crude secondary steel ex-caster.	casting are not included. For the determination of indirect emissions, the total electricity consumption within the system boundaries shall be considered.	
EAF high alloy steel	Steel containing 8 % or more metallic alloying elements or where high surface quality and processability is required. Expressed in tonnes of crude secondary steel ex-caster.	All processes directly or indirectly linked to the process units electric arc furnace, secondary metallurgy, casting and cutting, post-combustion unit, dedusting unit, vessels heating stands, casting ingots preheating stands, slow cooling pit, scrap drying and scrap preheating are included. The process units FeCr converter and cryogenic storage of industrial gases are not included. Processes downstream of casting are not included. For the determination of indirect emissions, the total electricity consumption within the system boundaries shall be considered.	0,352
Iron casting	Casted iron expressed as tonnes of liquid iron ready alloyed, skinned, and ready for casting.	All processes directly or indirectly linked to the process steps melting shop, casting shop, core shop and finishing are included. The process step 'finishing' refers to operations like fettling but not general matching, heat treatment or	0,325

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		<p>painting which are not covered by the system boundaries of this product benchmark.</p> <p>For the determination of indirect emissions, only the electricity consumption of melting processes within the system boundaries shall be considered.</p>	
Mineral wool	<p>Mineral wool insulation products for thermal, acoustic and fire applications manufactured using glass, rock or slag. Expressed in tonnes of mineral wool (saleable product).</p>	<p>All processes directly or indirectly linked to the production steps melting, fiberizing and injection of binders, curing and drying and forming are included.</p> <p>For the determination of indirect emissions, the total electricity consumption within the system boundaries shall be considered.</p>	0,682
Plasterboard	<p>The benchmark covers boards, sheets, panels, tiles, similar articles of plaster/compositions based on plaster, (not) faced/reinforced with paper/paperboard only, excluding articles agglomerated with plaster, ornamented (in tonnes of stucco, saleable product). High-density gypsum fibreboards are not covered by this product benchmark.</p>	<p>All processes directly or indirectly linked to the production steps milling, drying, calcining and board drying are included.</p> <p>For the determination of indirect emissions, only the electricity consumption of heat pumps applied in the drying stage shall be considered.</p> <p>The production of the intermediary product dried secondary gypsum is not covered by this benchmark.</p>	0,131
Carbon black	<p>Furnace carbon black, expressed in tonnes of furnace carbon black, saleable</p>	<p>All processes directly or indirectly linked to the production of furnace carbon black</p>	1,954

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	product, purity above 96 %. Gas- and lamp black products are not covered by this benchmark.	as well as finishing, packaging and flaring are included. For the determination of indirect emissions, the total electricity consumption within the system boundaries shall be considered. Exchangeability factor should be calculated considering electricity driven devices like pumps and compressors with a rated power of 2 MW or more.	
Ammonia	Ammonia (NH <sub>3</sub> ), expressed in tonnes produced, 100 % purity.	All processes directly or indirectly linked to the production of the ammonia and the intermediate product hydrogen are included. Ammonia production from other intermediate products is not covered. For the determination of indirect emissions, the total electricity consumption within the system boundaries shall be considered.	1,619
Steam cracking	Mix of high value chemicals (HVC) expressed in tonnes as total mass of acetylene, ethylene, propylene, butadiene, benzene and hydrogen exported out of the cracker perimeter excluding HVC from supplemental feed (hydrogen, ethylene, other HVC) with an ethylene content in	All processes directly or indirectly linked to the production of high value chemicals as purified product or intermediate product with concentrated content of the respective HVC in the lowest tradable form (raw C4, unhydrogenated pygas) are included except C4 extraction (butadiene plant),	0,702

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	the total product mix of at least 30 mass-percent and a content of HVC, fuel gas, butenes and liquid hydrocarbons of together at least 50 mass-percent of the total product mix	C4-hydrogenation, hydrotreating of pyrolysis gasoline & aromatics extraction and logistics/storage for daily operation. For the determination of indirect emissions, the total electricity consumption within the system boundaries shall be considered.	
Aromatics	Mix of aromatics expressed as CO <sub>2</sub> weighted tonne (CWT)	All processes directly or indirectly linked to the aromatics sub-units pygas hydrotreater, benzene/toluene/xylene (BTX) extraction, TDP, HDA, xylene isomerisation, P-xylene units, cumene production and Cyclo-hexane production are included. For the determination of indirect emissions, the total electricity consumption within the system boundaries shall be considered.	0,0295
Styrene	Styrene monomer (vinyl benzene, CAS number: 100-42-5). Expressed in tonnes of styrene (saleable product).	All processes directly or indirectly linked to the production of styrene as well as the intermediate product ethylbenzene (with the amount used as feed for the styrene production) are included. For installations producing both propylene oxide and styrene monomer, the facilities exclusively dedicated to propylene and	0,527

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		propylene oxide unit operations are excluded from this benchmark, and shared facilities are covered in proportion to the production in tonnes of the styrene monomer production. For the determination of indirect emissions, the total electricity consumption within the system boundaries shall be considered.	
Hydrogen	Pure hydrogen and mixtures of hydrogen and carbon monoxide having a hydrogen content $\geq 60\%$ volume fraction of total contained hydrogen plus carbon monoxide based on the aggregation of all hydrogen- and carbon-monoxide-containing product streams exported from the sub-installation concerned expressed as tonnes of 100 % pure hydrogen, as net saleable product.	All relevant process elements directly or indirectly linked to the production of hydrogen and the separation of hydrogen and carbon monoxide are included. These elements lie between: <ul style="list-style-type: none"> <li>a) the point(s) of entry of hydrocarbon feedstock(s) and, if separate, fuel(s);</li> <li>b) the points of exit of all product streams containing hydrogen and/or carbon monoxide;</li> <li>c) the point(s) of entry or exit of import or export heat.</li> </ul> For the determination of indirect emissions, the total electricity consumption within the system	8,85



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		boundaries shall be considered.	
Synthesis gas (syngas)	Mixtures of hydrogen and carbon monoxide having a hydrogen content < 60 % volume fraction of total contained hydrogen plus carbon monoxide based on the aggregation of all hydrogen- and carbon-monoxide-containing product streams exported from the sub-installation concerned. Expressed in tonnes of synthesis gas referred to 47 volume-percent hydrogen as net saleable product.	All relevant process elements directly or indirectly linked to the production of syngas and the separation of hydrogen and carbon monoxide are included. These elements lie between: a) the point(s) of entry of hydrocarbon feedstock(s) and, if separate, fuel(s) b) the points of exit of all product streams containing hydrogen and/or carbon monoxide c) the point(s) of entry or exit of import or export heat  For the determination of indirect emissions, the total electricity consumption within the system boundaries shall be considered.	0,242
Ethylene oxide/ethylene glycols	The ethylene oxide/ethylene glycol benchmark covers the products ethylene oxide (EO, high purity), monoethylene glycol (MEG, standard grade + fiber grade (high purity)), diethylene glycol	All processes directly or indirectly linked to the process units EO production, EO purification and glycol section are included. The total electricity consumption (and the related indirect emissions) within the system boundaries	0,512

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(DEG), triethylene glycol (TEG). The total amount of products is expressed in terms of tonnes of EO-equivalents (EOE), which are defined as the amount of EO (in mass) that is embedded in one mass unit of the specific glycol.	is covered by this product benchmark.
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If no other reference is given, all product benchmarks refer to 1 ton of product produced expressed as saleable (net) production and to 100 % purity of the substance concerned.

All definitions of processes and emissions covered (system boundaries) include flares where they occur.

### 3. Heat and fuel benchmarks

<b>Benchmark</b>	<b>Starting point for determination of annual reduction rate for benchmark value update(allowances/TJ)</b>
Heat benchmark	62,3
Fuel benchmark	56,1

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